



# Geospatial Intelligence Standards Working Group

## NSG Enterprise Vocabulary (NEV) Overview

Nathan J. Babcock, NGA,  
GEOINT Content Semantic Resources  
Program Lead  
21 December 2017

# NSG Core Vocabulary (NCV) Standard

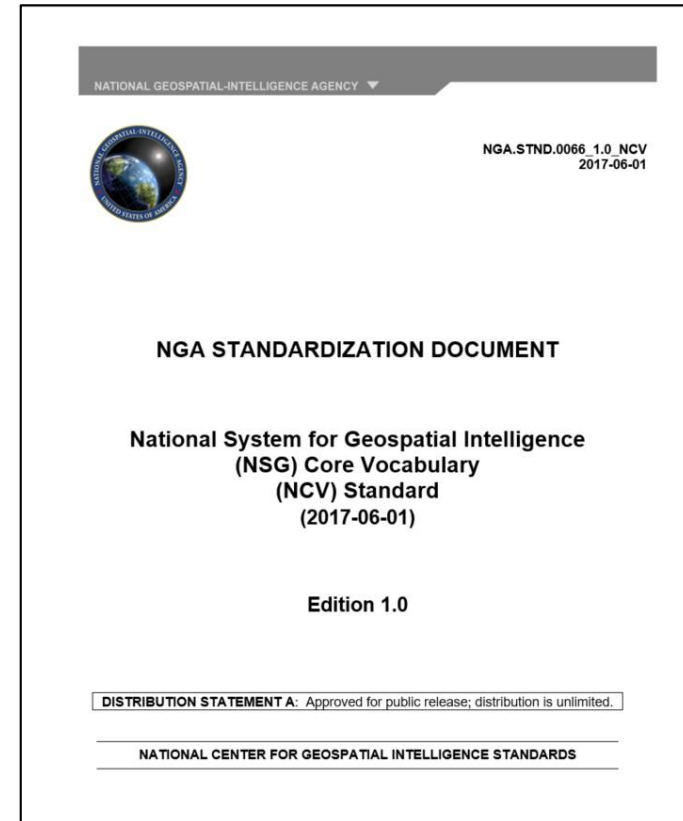
- **Title: “National System for Geospatial Intelligence (NSG) Core Vocabulary (NCV) Standard”**
- **NCV Standard includes**
  - NGA Standard document: NGA.STND.0066\_1.0\_NCV
  - NCV content: Technical artifacts (2 W3C-based SKOS encodings)
  - Resources available via REST API component of the NSGREG
- **NSG Core Vocabulary Home Page: <http://nsgreg.nga.mil/ncv>**
- **Part of a family of GEOINT Content Semantic Resources**
  - Abbreviation: “GCSR”
  - GCSR includes the NSG Application Schema (NAS), currently in use
  - Three new standards specify Semantic Web-enabled technical artifacts
    - NSG Core Vocabulary (NCV)
    - NSG Taxonomy (NTAX)
    - NSG Enterprise Ontology (NEO)

Jump to  
GCSR Background



# NCV Standard Covers NSG Vocabularies

- Outline of NCV Standard DRAFT
- Body of the Document
  - Section 1: Scope
  - Section 2: Conformance
  - Section 3: References
  - Section 4: Terms, Definitions, and Acronyms
  - Section 5: Vocabulary Specification
  - Section 6: Governance
- Annexes
  - Annex A (**normative**): Conformance
  - Annex B (**normative**): ICS Pro Forma
  - Annex C (**normative**): NSG Enterprise Vocabulary (NEV) Specification
  - Annex D (**normative**): Utility Ontologies for NCV
  - Annex E (*informative*): Inspecting the NCV Content
  - Annex F (*informative*): UML Primer



# NCV Standard Scope: Terminology

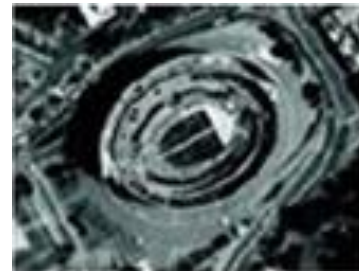
- **Specification for a controlled vocabulary of defined terms intended to consistently describe GEOINT information shared in the NSG**
  - *A controlled vocabulary* is a set of terms (CV elements) consisting of defined lexical items (for example: words, phrases, and/or abbreviations) from natural language that are collected and managed according to identified criteria. Examples: Glossaries, data dictionaries.
- **Vocabulary content consists of:**
  - Lexical items (names, phrases)
  - Natural-language definitions
- **Leverages established terminology created by GEOINT Subject-Matter Experts (SMEs)**
  - Selectively derived from the NSG Feature Data Dictionary (NFDD)
  - Selectively derived from content in the IR Registry



# The Semantic Triangle – Build 1

Term -----> Real-world Object  
“the Roman Coliseum”

***Theory of Denotation:*** Words  
are related to the world through  
the mediation of concepts.



# The Semantic Triangle – Build 2

**Meaning:** Terms represent concepts in the minds of language users.

- Terms in different languages may represent the same concept.
- Controlled vocabularies ensure that terms are used and understood consistently by users.

Term

“the Roman Coliseum”

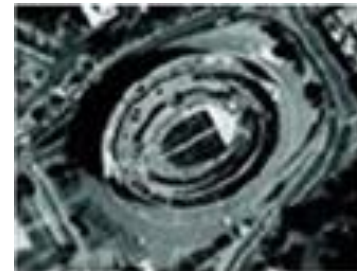
**Theory of Denotation:** Words are related to the world through the mediation of concepts.



Concept

Name: “Roman Coliseum”  
Alias: “Flavian Amphitheatre”  
Entity type: Stadium  
Definition: “An oval amphitheater in Rome built by Imperial order in the first century C.E.”  
Location: Rome, Italy  
Position: N41° 53'25", E12°29'32"

Real-world Object



# The Semantic Triangle – Build 3

**Meaning:** Terms represent concepts in the minds of language users.

- Terms in different languages may represent the same concept.
- Controlled vocabularies ensure that terms are used and understood consistently by users.

Term

“the Roman Coliseum”

**Theory of Denotation:** Words are related to the world through the mediation of concepts.

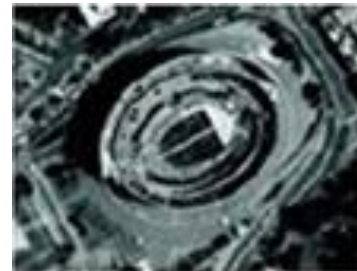


Concept

Name: “Roman Coliseum”  
Alias: “Flavian Amphitheatre”  
Entity type: Stadium  
Definition: “An oval amphitheater in Rome built by Imperial order in the first century C.E.”  
Location: Rome, Italy  
Position: N41° 53’25”, E12°29’32”

**Interpretation:** Concepts are constituents of mental models used by humans to apply language to the real world.

Real-world Object





# The Semantic Triangle – Build 4

*signified (meaning)*

**Meaning:** Terms represent concepts in the minds of language users.

- Terms in different languages may represent the same concept.
- Controlled vocabularies ensure that terms are used and understood consistently by users.

Term

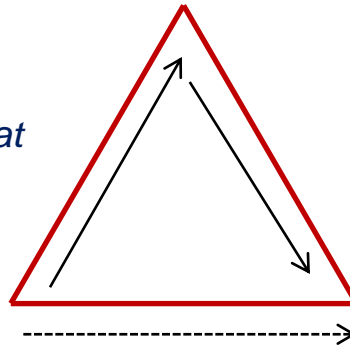
“the Roman Coliseum”

*signifier (sign)*

**Theory of Denotation:** Words are related to the world through the mediation of concepts.



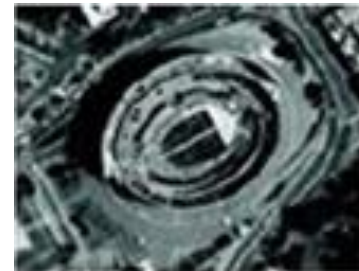
Concept



Name: “Roman Coliseum”  
Alias: “Flavian Amphitheatre”  
Entity type: Stadium  
Definition: “An oval amphitheater in Rome built by Imperial order in the first century C.E.”  
Location: Rome, Italy  
Position: N41° 53'25”,  
E12°29'32”

**Interpretation:** Concepts are constituents of mental models used by humans to apply language to the real world.

Real-world Object



*referent (object)*



# The Semantic Triangle – Build 5

*signified (meaning)*

**Meaning:** Terms represent concepts in the minds of language users.

- Terms in different languages may represent the same concept.
- Controlled vocabularies ensure that terms are used and understood consistently by users.

Term

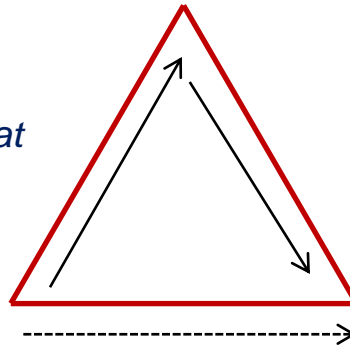
“the Roman Coliseum”

*signifier (sign)*

NCV Standard covers  
Vocabulary Terms

**Theory of Denotation:** Words are related to the world through the mediation of concepts.

Concept

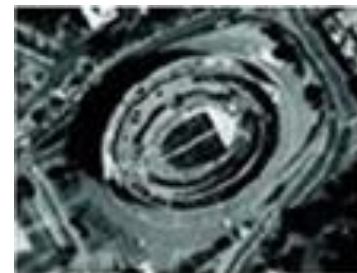


Name: “Roman Coliseum”  
Alias: “Flavian Amphitheatre”  
Entity type: Stadium  
Definition: “An oval amphitheater in Rome built by Imperial order in the first century C.E.”  
Location: Rome, Italy  
Position: N41° 53’25”,  
E12°29’32”

NAS & NEO Standards  
cover detailed  
Concept models

**Interpretation:** Concepts are constituents of mental models used by humans to apply language to the real world.

Real-world Object



*referent  
(object)*

Formal encoding of terms & concepts enables machines to help users share words and meanings.

# Terms vs. Concepts

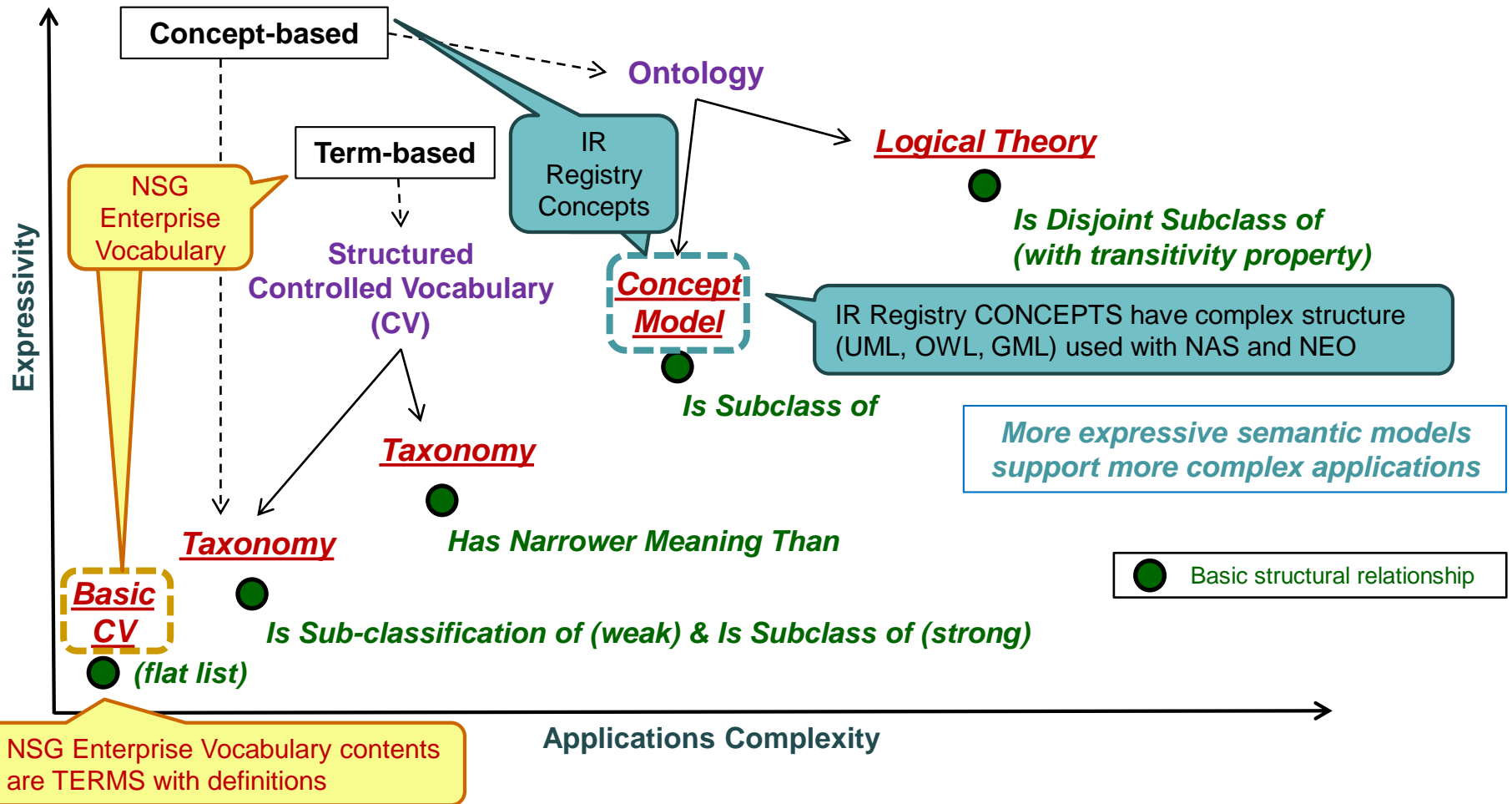
## Terms

- Lexical items
  - Words, phrases, or abbreviations
- Defined in human language
- Enable understanding of a shared domain language
- Represented in flat lists
  - Dictionaries
- May be encoded
  - Language-specific strings
- Provided as a terminology resource
  - Simple(r)

## Concepts

- Structured items
  - Entity types and properties (abstractions of real-world objects)
- Defined in formal models
- Enable understanding of shared structured datasets
- Represented in schemas
  - UML
  - Ontologies (e.g., OWL)
- May be encoded
  - Logic-based languages
- Provided as a resource for data modeling and interoperability
  - Complex

# Spectrum of Semantic Resources



# Vocabulary Specification

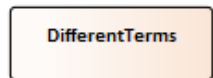
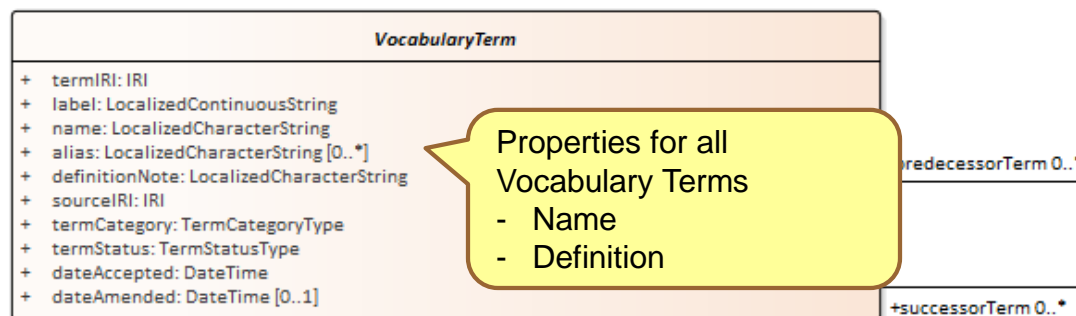
- **NSG Vocabulary Information Model (*Content Specification*)**
  - *VocabularyTerm {Abstract}* with subclasses *BasicTerm* & *ComplexTerm*
  - Represented in W3C Simple Knowledge Organization System (SKOS)
- **IRIs\* and Namespace (*Content Identification*)**
  - Unique identifiers implemented with URI/URLs to locate resources
  - Related items collected within namespaces
- **SKOS Representation (*Content Encoding*)**
  - Simple Knowledge Organization System (SKOS) representation
  - SKOS technical artifacts are encoded in RDF/XML and N-Triples
  - Supports use of Vocabulary concepts in indexing, query, and search
  - Supports use of Vocabulary concepts with Linked Data

\*An Internationalized Resource Identifier (IRI) is a sequence of characters from the Universal Character Set (Unicode/ISO 10646) that forms an identifier for a resource. IRIs complement an older format, Uniform Resource Identifiers (URIs), which allows the use of only a subset of the ASCII character set to construct identifiers. Every URI is by definition an IRI. Reference: <http://tools.ietf.org/html/rfc3987#section-3.1>



# NSG Vocabulary Information Model

Content  
Specification



+distinctMemberTerm 2..\*

+narrowerTerm 0..\*

+broaderTerm 0..1

**BasicTerm**

+memberTermOf 0..1

+hasMemberTerm 1..\*

+topTermOf 0..1

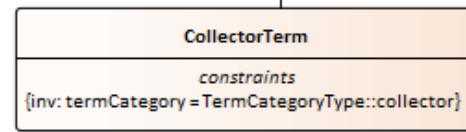
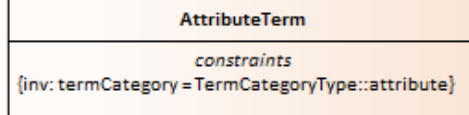
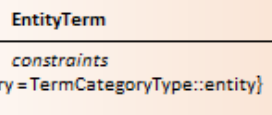
+hasTopTerm 1..\*

**ComplexTerm**

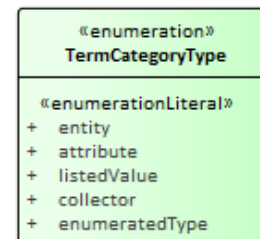
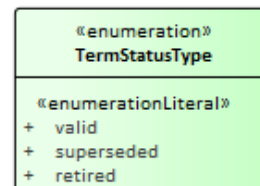
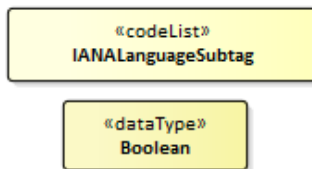
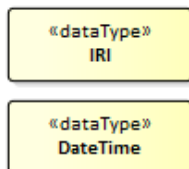
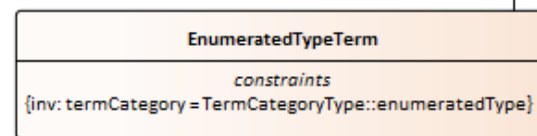
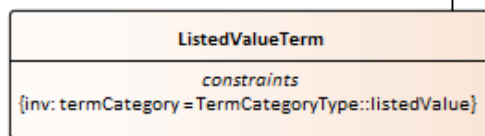
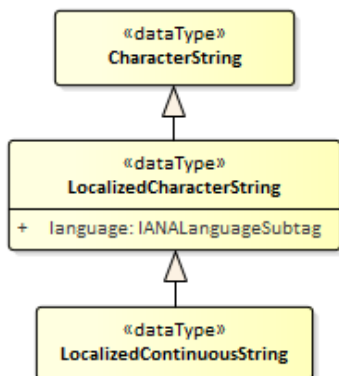
+ valuesComplete: Boolean

Sets of Terms

Types of  
Basic Term



Types of  
Complex Term



# NCV Namespace and Identifiers

- **Namespace**

- A collection of conceptually related resources whose identifiers (IRIs) share a common prefix (“URI base”).
- Each resource IRI belongs to a single namespace.
- Resources from different namespaces may be combined in the construction of a new resource (“re-use”).

- **NSG Core Vocabulary Identifier**

- A unique identifier (IRI) is assigned to the vocabulary as a whole:
  - <http://api.nsgreg.nga.mil/vocabulary/ncv>

- **Form of IRIs for NCV Components**

- protocol “:” domain “/” resource-type “/” resource “/” concept
- Example: <http://api.nsgreg.nga.mil/vocabulary/ncv/Building>

- **Vocabulary Baselines and Vocabulary Term Status**

- Authoritative NCV content is published with baseline metadata
- Non-versioned IRI retrieves the latest NCV content through the REST API
- Status for individual Vocabulary Terms is recorded for each term



# NSG Vocabulary Encodings

- **Simple Knowledge Organization System (SKOS)**
  - SKOS provides a Web-enabled representation for terminology
- **The NSG vocabulary information model is formalized in SKOS.**
  - NCV Basic Terms are represented by `skos:Concept`.
  - NCV Complex Terms are represented by `skos:ConceptScheme`.
  - SKOS properties are used for Term documentation
- **NSG vocabularies have two encodings**
  - RDF/XML: an XML-based format for encoding an RDF graph
  - N-Triples: a line-based, plain text format for encoding an RDF graph as a set of “Subject-Predicate-Object” (S-P-O) triples



# NSG Enterprise Vocabulary (NEV)

- The NCV Standard, Annex C, presents the specification for the NSG Enterprise Vocabulary (NEV)
- NEV components use the same NSG vocabulary information model as NCV content
- Content of NEV components is related to selected contents of the IR Registry
- **NEV = NCV + NEV components**

NSG Core Vocabulary (NCV) Standard, Edition 1.0

## Annex C – NSG Enterprise Vocabulary (NEV) Specification (Normative)

### C.1 Introduction

The NSG Enterprise Vocabulary (NEV) is a collection of controlled vocabularies including the NSG Core Vocabulary (NCV), which conform to the NSG vocabulary information model and which may be used together to describe geospatial intelligence (GEOINT) shared in the National System for Geospatial Intelligence (NSG).

This Annex specifies the IRIs for NEV resources that are based on the content of the Information Resources Registry of the NSG Standards Registry (Section C.2). Content will be published in the future.

This Annex also describes the requirements (Sections C.3, C.4, C.5, C.6) for any controlled vocabulary to be a component of the NEV.

### C.2 IRIs

IRIs for the NEV and its components are constructed in accordance with the following pattern specified in the NCV Standard, Section 5.5.2, with each vocabulary having its own *resource* abbreviation, based on the name of the resource:

*protocol "://" domain "/" resource-type "/" resource "/" concept*

In this pattern, each component is case-sensitive and determined as follows:

- *protocol* – always 'http'
- *domain* – always 'api.nsgreg.nga.mil'
- *resource-type* – always 'vocabulary'
- *resource* – abbreviation for a specific resource (e.g., 'ncv' for the NCV, 'nev' for the NEV)
- *concept* – designates an individual vocabulary term (e.g., 'Aerial', 'Building', 'MountainPass')

The individual components are concatenated into a single string as specified by the pattern (above), to form the IRI that designates the associated vocabulary component.

The IRI for the NEV is <http://api.nsgreg.nga.mil/vocabulary/nev>.

The identifiers established for component vocabularies of the NSG Enterprise Vocabulary are listed in Table 19.

Table 19 – IRIs for NEV and Component Vocabularies

Name	Resource IRI
Codelist	<a href="http://api.nsgreg.nga.mil/vocabulary/codelist">http://api.nsgreg.nga.mil/vocabulary/codelist</a>
Belief System	<a href="http://api.nsgreg.nga.mil/vocabulary/belief-system">http://api.nsgreg.nga.mil/vocabulary/belief-system</a>
Linguistic Entity	<a href="http://api.nsgreg.nga.mil/vocabulary/linguistic-entity">http://api.nsgreg.nga.mil/vocabulary/linguistic-entity</a>
Physical Quantity	<a href="http://api.nsgreg.nga.mil/vocabulary/physical-quantity">http://api.nsgreg.nga.mil/vocabulary/physical-quantity</a>

**NSG Enterprise Vocabulary (NEV) IRI:**

<http://api.nsgreg.nga.mil/vocabulary/nev>



# NEV Components for IR Resources

- **Information Resources (IR) Registry resources specify many specialized NSG domain concepts**
- **NEV component vocabularies define *terminology* for IR Registry content**
  - One vocabulary for each IR Register
- **Vocabulary terms don't capture the logical complexities of the IR Registry concepts**
  - Terms are lexical items with definitions
  - Terms are entry points for human understanding
  - Encoded terms may be used for indexing, tagging, and term search
- **IR Registry concepts are based on complex information models**
  - Conceptual models are used to represent structured knowledge
  - Represented in UML, GML, OWL



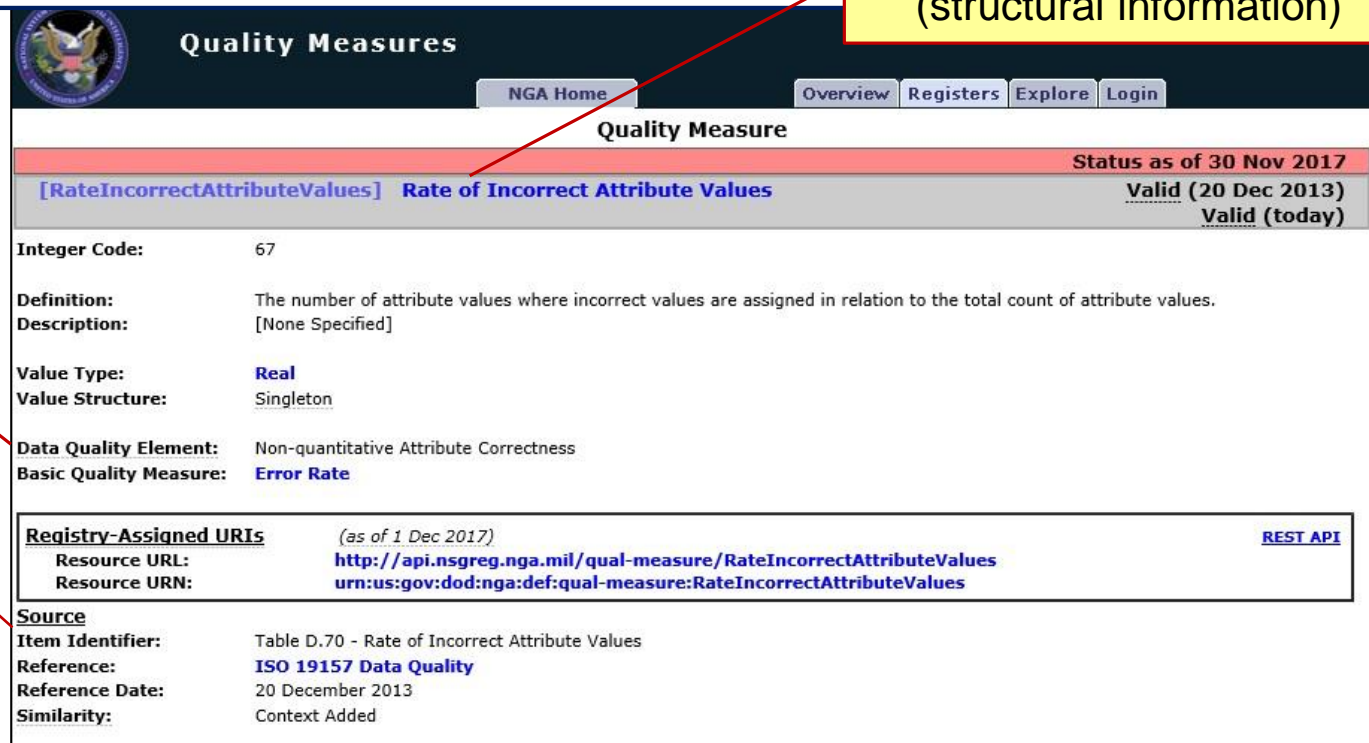
# Example: QMV Term for a QM Concept

Quality Measures Vocabulary term (lexical information)

**name:** Rate of Incorrect Attribute Values  
**termIRI:** <http://api.nsgreg.nga.mil/vocabulary/quality-measure/RateIncorrectAttributeValues>  
**label:** RateIncorrectAttributeValues  
**definitionNote:** Definition: The number of attribute values where incorrect values are assigned in relation to the total count of attribute values. Value Type: Real (Singleton)  
**termCategory:** attribute  
**sourceIRI:** <http://nsgreg.nga.mil/ir/view?i=300099>  
**termStatus:** Valid

Correlated IR QM concept (structural information)

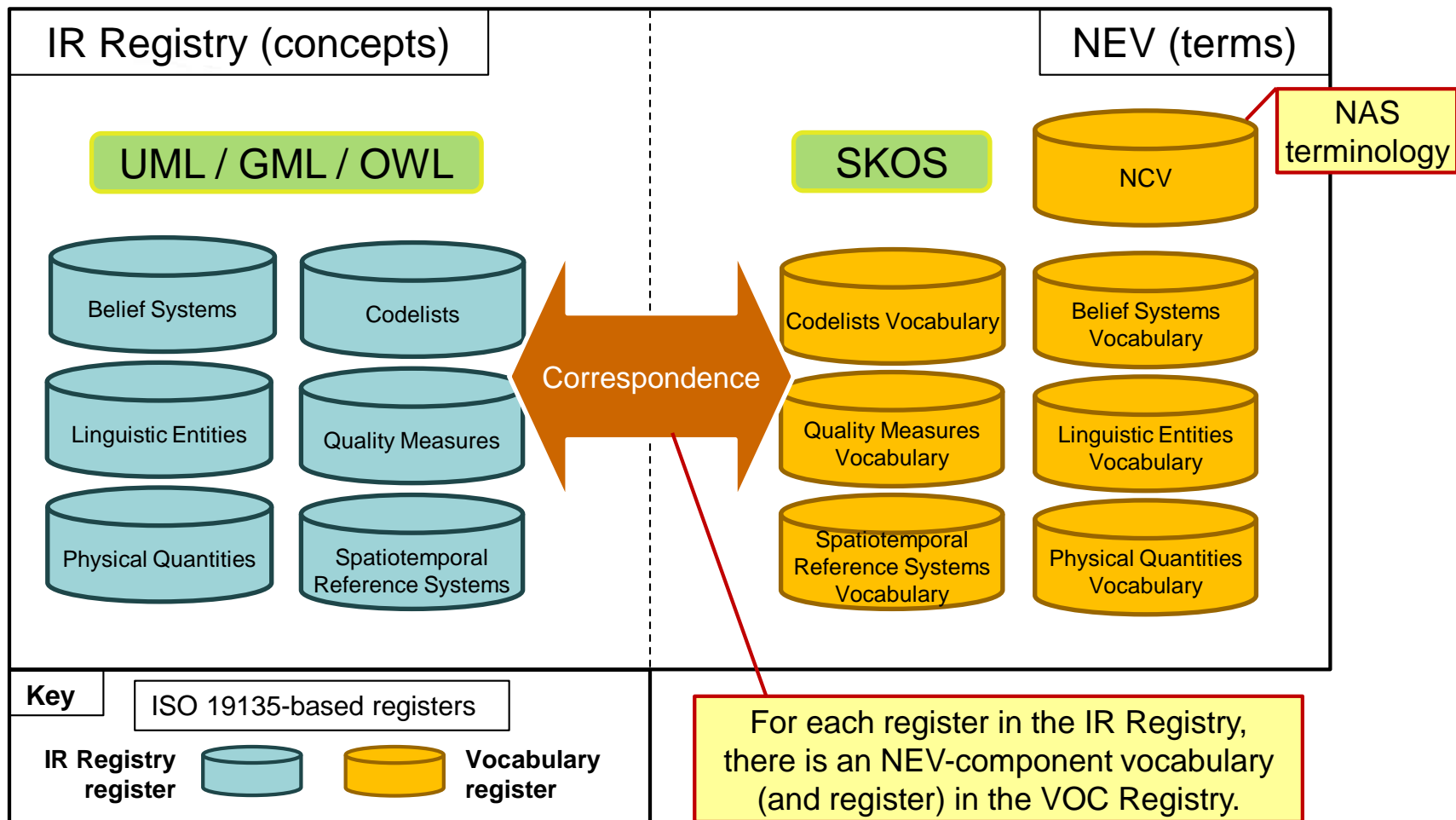
Additional structural information



The screenshot displays the 'Quality Measures' web application. At the top, there is a navigation bar with 'NGA Home', 'Overview', 'Registers', 'Explore', and 'Login'. The main heading is 'Quality Measure'. Below this, a table lists the quality measure 'Rate of Incorrect Attribute Values' with a status of 'Valid (20 Dec 2013)' and 'Valid (today)'. The table also shows the 'Integer Code' as 67. The 'Definition' section states: 'The number of attribute values where incorrect values are assigned in relation to the total count of attribute values.' The 'Value Type' is 'Real' and the 'Value Structure' is 'Singleton'. The 'Data Quality Element' is 'Non-quantitative Attribute Correctness' and the 'Basic Quality Measure' is 'Error Rate'. The 'Registry-Assigned URIs' section provides the 'Resource URL' as <http://api.nsgreg.nga.mil/qual-measure/RateIncorrectAttributeValues> and the 'Resource URN' as <urn:us:gov:dod:nga:def:qual-measure:RateIncorrectAttributeValues>. The 'Source' section identifies the 'Item Identifier' as 'Table D.70 - Rate of Incorrect Attribute Values', the 'Reference' as 'ISO 19157 Data Quality', the 'Reference Date' as '20 December 2013', and the 'Similarity' as 'Context Added'.

Quality Measure		Status as of 30 Nov 2017
[RateIncorrectAttributeValues]	Rate of Incorrect Attribute Values	Valid (20 Dec 2013) Valid (today)
Integer Code:	67	
Definition:	The number of attribute values where incorrect values are assigned in relation to the total count of attribute values.	
Description:	[None Specified]	
Value Type:	Real	
Value Structure:	Singleton	
Data Quality Element:	Non-quantitative Attribute Correctness	
Basic Quality Measure:	Error Rate	
<b>Registry-Assigned URIs</b> (as of 1 Dec 2017) <a href="#">REST API</a>		
Resource URL:	<a href="http://api.nsgreg.nga.mil/qual-measure/RateIncorrectAttributeValues">http://api.nsgreg.nga.mil/qual-measure/RateIncorrectAttributeValues</a>	
Resource URN:	<a href="urn:us:gov:dod:nga:def:qual-measure:RateIncorrectAttributeValues">urn:us:gov:dod:nga:def:qual-measure:RateIncorrectAttributeValues</a>	
<b>Source</b>		
Item Identifier:	Table D.70 - Rate of Incorrect Attribute Values	
Reference:	ISO 19157 Data Quality	
Reference Date:	20 December 2013	
Similarity:	Context Added	

# IR Registers Paired with NEV Components



# NEV Vocabularies vs. IR Registry Concepts

Vocabulary Name	Scope	IR Registry Item Classes
Belief Systems Vocabulary	A vocabulary for perspectives about the world held by human beings (past or present), often as part of a shared subculture.	Belief System
Codelists Vocabulary	A vocabulary for sets of value domains that are used to specify geospatial data and metadata.	Datatype & Listed Value
Linguistic Entities Vocabulary	A vocabulary for systems of sounds, characters, symbols, or signs used to express or communicate meaning or messages between humans.	Linguistic Entity
Physical Quantities Vocabulary	A vocabulary for properties having a magnitude that can be expressed by means of a number (physical value) and a reference quantity (referred to as a “unit of measure”).	Physical Quantity, Unit of Measure, Unit Multiple
Quality Measures Vocabulary	A vocabulary for evaluation procedures used to determine the degree to which the inherent characteristics of data fulfil requirements.	Quality Measure, Basic Quality Measure, Quality Measure Parameter
Spatiotemporal Reference Systems Vocabulary	A vocabulary for reference systems and related components that are used to specify spatial and/or temporal aspects of geospatial data and metadata.	SRS Coordinate Reference System, SRS Coordinate System, SRS Coordinate System Axis, SRS Datum, SRS Prime Meridian, SRS Ellipsoid, SRS Coordinate Operation, SRS Operation Method, SRS Operation Parameter, Spatiotemporal Direction

# IRIs for NEV Components

Vocabulary Name	Code	Resource IRI
Codelists Vocabulary	CDV	<a href="http://api.nsgreg.nga.mil/vocabulary/codelist">http://api.nsgreg.nga.mil/vocabulary/codelist</a>
Belief Systems Vocabulary	BSV	<a href="http://api.nsgreg.nga.mil/vocabulary/belief-system">http://api.nsgreg.nga.mil/vocabulary/belief-system</a>
Linguistic Entities Vocabulary	LEV	<a href="http://api.nsgreg.nga.mil/vocabulary/linguistic-entity">http://api.nsgreg.nga.mil/vocabulary/linguistic-entity</a>
Physical Quantities Vocabulary	PQV	<a href="http://api.nsgreg.nga.mil/vocabulary/physical-quantity">http://api.nsgreg.nga.mil/vocabulary/physical-quantity</a>
Quality Measures Vocabulary	QMV	<a href="http://api.nsgreg.nga.mil/vocabulary/quality-measure">http://api.nsgreg.nga.mil/vocabulary/quality-measure</a>
Spatiotemporal Reference Systems Vocabulary	SRV	<a href="http://api.nsgreg.nga.mil/vocabulary/coord-ref-system">http://api.nsgreg.nga.mil/vocabulary/coord-ref-system</a>

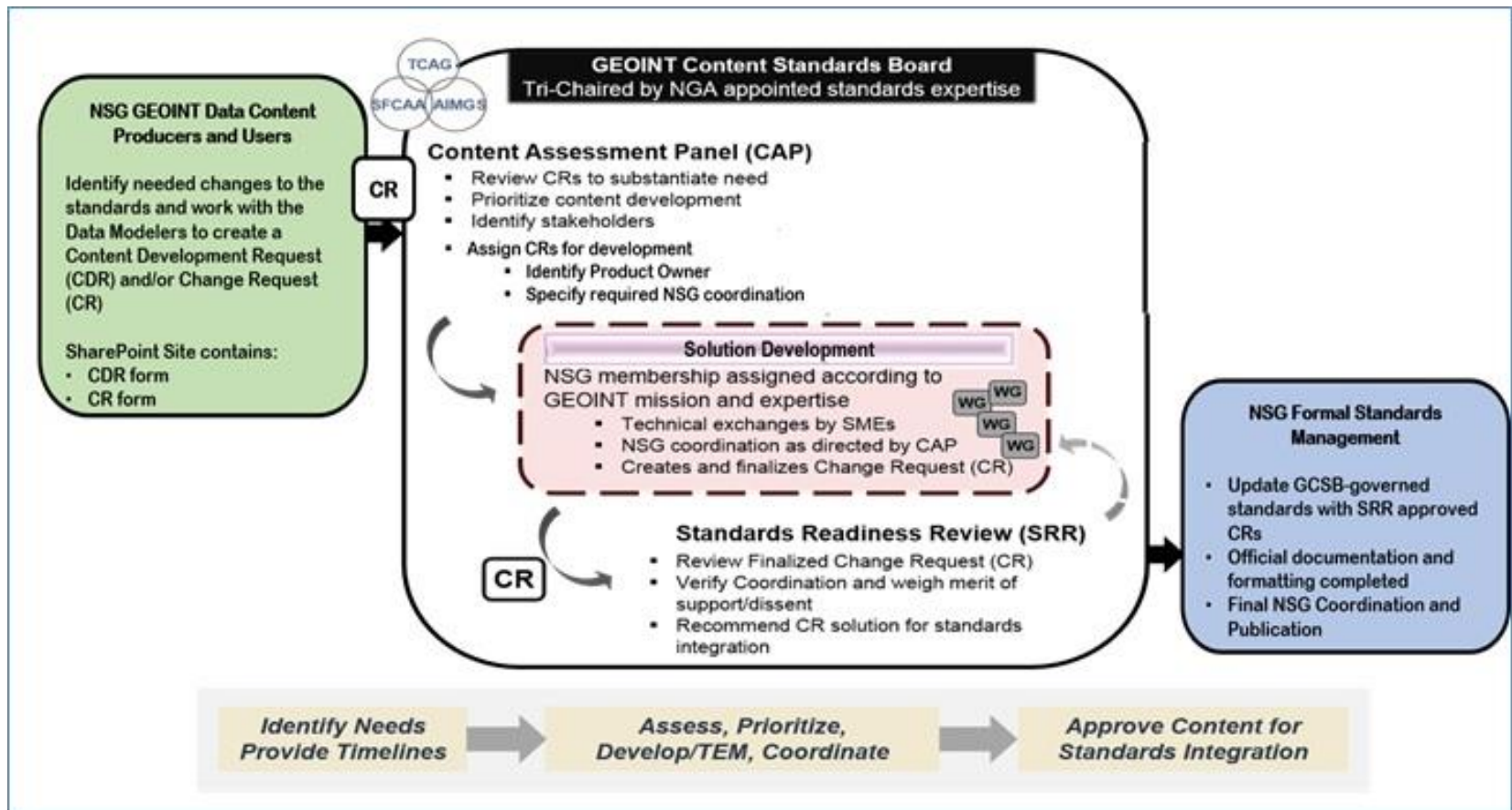
# Publication

- **GCSR Standards (NAS, NEO, NTAX, & NCV) and associated technical artifacts are published in the NSG-unique Standards Register of the NSG Standards Registry**
- **NSG Core Vocabulary (NCV) Standard**
  - “National System for Geospatial Intelligence (NSG) Core Vocabulary (NCV) Standard” (NGA.STND.0066\_1.0\_NCV)
  - MS Word document containing the vocabulary specification and the conformance test suite
  - URL: <http://nsgreg.nga.mil/doc/view?i=2617>
- **Managed content**
  - NCV Register (online)
  - Technical artifacts
    - RDF/XML encoding of the NSG Core Vocabulary (content)
    - N-Triples encoding of the NSG Core Vocabulary (content)
  - Online resources accessible through the REST API component of the NSG Standards Registry
    - Resources for individual terms, as well as for the vocabulary as a whole
    - HTTP content negotiation used to specify media type (RDF/XML or N-Triples)





# Governance



- The GEOINT Content Standards Board (GCSB) manages the GCSR Standards
- The *GCSB Operations Guide* specifies GCSB management roles and processes.
- The GCSB oversees publication of the GCSR Standards and technical artifacts.

# Point of Contact

**Nathan J. Babcock** ([Nathan.J.Babcock@nga.mil](mailto:Nathan.J.Babcock@nga.mil))

- GEOINT Content Semantic Resources Program Lead, NGA CIO & IT Services Directorate
- Chair, GWG Metadata Focus Group ([mfgchair@nga.mil](mailto:mfgchair@nga.mil)) and Application Schemas for Feature Encoding (ASFE) Focus Group ([asfechair@nga.mil](mailto:asfechair@nga.mil))



# **BACKGROUND: GEOINT CONTENT SEMANTIC RESOURCES (GCSR)**



# Types of Semantic Resources

Semantic Resource Type	Definition
<b>Basic Controlled Vocabulary (CV)*</b>	A set of terms (CV Elements) consisting of defined lexical items (for example: words, phrases, and/or abbreviations) from natural language that are collected and managed according to identified criteria. Examples: Glossaries, data dictionaries.
<b>Taxonomy</b>	A hierarchical (tree) structure consisting of either (1) a collection of terms (term-taxonomy) or (2) a collection of concepts, arranged into a subordination tree. Strict (“strong”) and loose (“weak”) taxonomies are distinguished based on the type of hierarchical relationship used ( <b>subclass</b> vs. <b>sub-classification</b> , respectively). Examples: Library of Congress classification (weak taxonomy); Linnaean classification of animals (strong taxonomy).
<b>Thesaurus</b>	A collection of defined terms structured by several standardized lexical relationships, including: <i>narrower-than</i> and <i>broader-than</i> (for loose/weak hierarchies); <i>used-for</i> (to indicate synonyms); <i>related-to</i> (for relationships); and <i>preferred-term</i> may be indicated. Examples: Roget’s Thesaurus, Thesaurus.com.
<b>Concept Model</b>	A complex formalization of concepts for representing domain objects using classes, attributes, hierarchical ( <i>subclass-of</i> ) relationships, and other relationships (associations) between classes of objects. The structure of a concept model is a graph rather than a tree. Example: UML models.
<b>Ontology (Logical Theory)</b>	A logical theory for a domain (part or all of the world), including formally defined concepts and properties, with restrictions and optionally rules, in which the structural relationships (including <i>subclass-of</i> , <i>equivalence</i> , and <i>disjoint-with</i> ) are defined in a formal logic (either axiomatically or in a rule-based formulation). “An ontology is an explicit specification of a conceptualization.” (Thos. R. Gruber) Examples: Basic Formal Ontology (BFO), Suggested Upper Merged Ontology (SUMO); Friend of a Friend (FOAF).

\* “Controlled Vocabulary” may be used generically to include dictionaries, term-taxonomies, and thesauri. “Basic CV” is used to distinguish simple glossary CVs from more complex CVs that include relationships between terms.

# New GCSR Standards & Web-enabled Resources

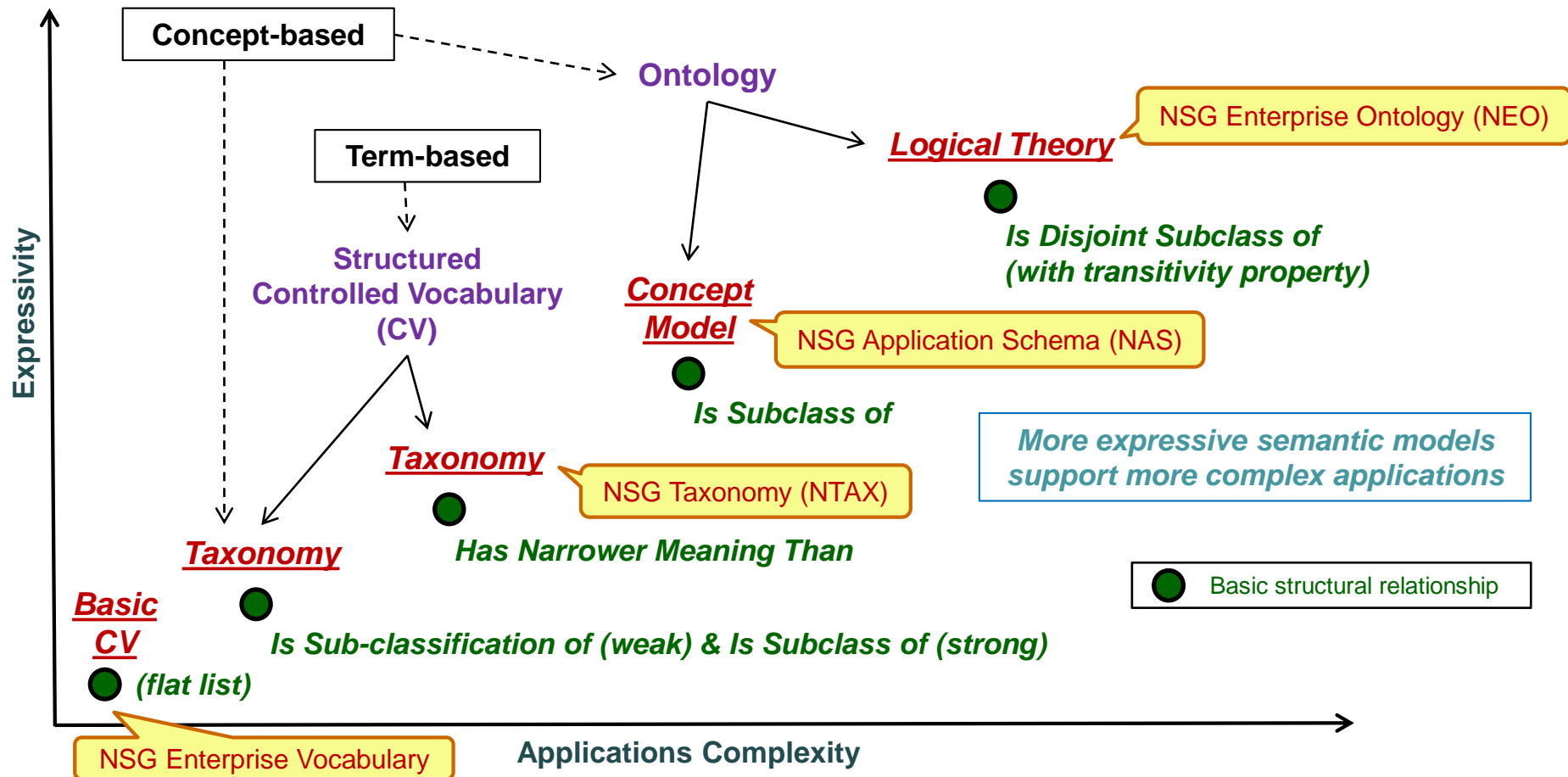
- **NSG Taxonomy (NTAX)**
  - Entity Class hierarchy for classification of GEOINT shared on the NSG
  - Semantic Web-enabled using Web Ontology Language (OWL 2)
  - Conceptual content based on NSG Application Schema\* entity types
- **NSG Core Vocabulary (NCV)**
  - Controlled terminology for describing GEOINT shared in the NSG
  - Web-enabled using Simple Knowledge Organization System (SKOS)
  - Specification for the **NSG Enterprise Vocabulary (NEV)\*\***
- **NSG Enterprise Ontology (NEO)**
  - Large multi-domain GEOINT ontology with a complex design-space
  - Web-enabled using Web Ontology Language (OWL 2) + SKOS
  - Content derived from the NAS using ISO rule-based approach
- **NSG Enterprise Thesaurus (NET)**
  - Potential to link other SKOS-encoded terminologies across the NSG
  - NCV can be related to other terminologies (as synonyms; broader/narrower terms; related terms)

\* For NAS, see <http://nsgreg.nga.mil/nas/>

\*\* In NCV Standard, Ed. 1.0, Annex C

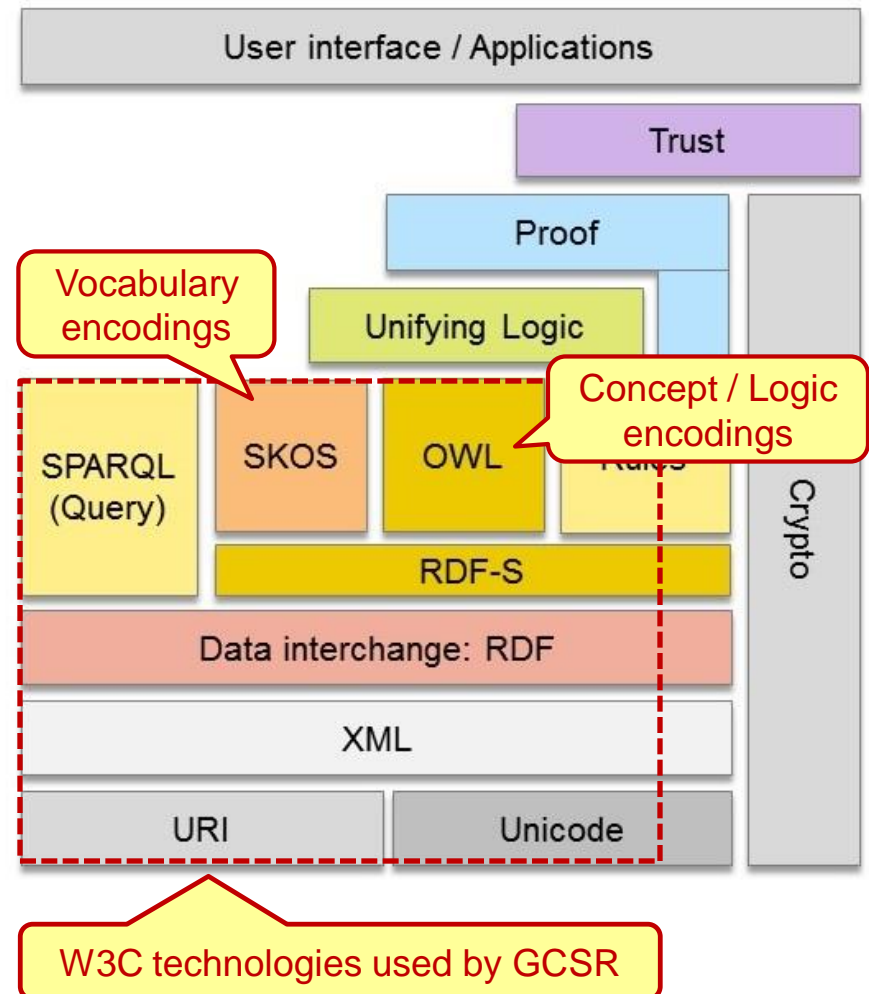


# Spectrum of Semantic Resources



# Technologies in the Semantic Web “Stack”

- “Layered” use of multiple standards to support interoperability of data with machine-processible semantics on the internet
- **Foundation:** URIs to identify Web resources
- **Structure:** XML for syntax
- **Semantics:** World Wide Web Consortium (W3C) standards (“Recommendations”)
  - Resource Description Framework (RDF)
  - RDF Schema (RDF-S)
  - Web Ontology Language (OWL)
  - Simple Knowledge Organization System (SKOS)





# Uses of Semantic Resources in Applications

Applications	CV	Thesaurus	Taxonomy	Concept Model	Ontology
Terminology services (e.g., definitions, synonyms)	X	X			
Labeling (e.g., menus, interfaces)	X	X			
Categorization (e.g., of documents or data instances)			X	X	X
Indexing (e.g., multimedia collection resources)	X	X	X	X	X
Search (Keyword)	X	X	X	X	X
Search (Semantic)		X	X	X	X
Navigation		X	X	X	X
Content representation (e.g., domain ontology)			X	X	X
Constraint assertions and checking			X	X	X
Web Services			X	X	X
Mapping models (e.g., to a reference ontology)				X	X
Data integration (instance-level)				X	X
Unified querying over heterogeneous data					X
Inference (derive new information about data)					X
Semantics for Linked Data (M2H; M2M)					X



**RETURN TO NEV OVERVIEW**